

Calgary Cigarette Butt Collection Study:

What is the Butt Density on Sidewalks and Street Gutters

and

How Long does it take to Collect a Litre of Butts?

by

Robert Norvin Crawford

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Synopsis.

For the purpose of determining a Fair Financial Incentive for the work of Collecting Cigarette Butts from City Streets, and also discovering other Practical facts about this type of activity, six downtown city blocks plus two grassy areas were selected and all cigarette butts were collected monthly. This study continued for four consecutive months (July to October) during the summer of 2023 in the downtown area of The City of Calgary. Number of Butts collected and their total Volume in Litres, as well as the time to collect were recorded. Collection Areas were measured. The main facts are: 1. a motivated person, who is not afraid of working up a little sweat, can collect 0.8 Litres of Butts per hour, 2. a one Litre container holds a median of 475 butts, 3. In 2023, the average density of butts on sidewalks was 0.29 butts per square meter of sidewalk including associated street gutter. 4. The typical density of butts in a grassy area, such as a park, was 0.18 butts per square meter. Based on these facts, we can calculate that for a person to earn the Alberta Minimum Wage of fifteen dollars per hour, a refundable recycling deposit of four cents per cigarette would have to be imposed and paid to those who present collected butts to a bottle depot. The, equivalent, per litre, incentive payment would be nineteen dollars and these incentives ought to be considered the bare minimum. Based on the data, a person would have to spend about two and a half hours a month to collect the butts of just a single one-pack-a-day smoker, and there are calculated to be about 150,000 smokers in Calgary. Other facts and trends are presented and discussed.

Introduction.

It is not very pleasant to walk down a sidewalk littered with cigarette butts. This is a particular problem in some areas of downtown Calgary. Like everything, some owners clean their sidewalks, such as the blocks with large commercial enterprises, like Banks and Malls, but most owners do not, so their sidewalks have a lot of cigarette butts.

How bad is the problem in Calgary, you might ask?

Sixteen years ago, J. J. Sunstrum (ABetterCalgary 2007b) produced a video titled *Calgary Cigarette Pollution*, published by *A Better Calgary* showing cigarette butts on the sidewalks of Steven Avenue Mall. Sunstrum was, at the time, a Candidate for Mayor of Calgary. In a second video (ABetterCalgary 2007a), also published by *A Better Calgary*, titled *Smoking*, he complained about the cigarette butt litter in Calgary and the need to address the issue.

A second example is that of Jerry Forbes (coreyAstralMedia 2009), a host of CJAY92FM-Calgary, who hosted a radio show and ran a contest titled *Tougher Than Tough*. The task for the contest was, to collect and turn in, 10,000 cigarette butts. Sheena Gallager won the contest working over the weekend and got the prize of five hundred dollars - that is four cents per cigarette butt. According to my experience in this study, I estimate that it would have taken her - at a minimum - thirteen hours per day for two days to accomplish this feat and that her body would have been very sore after such an ordeal. So, we can say that the problem has persisted for a long time in Calgary, despite the efforts of some citizens to fix the problem.

More broadly, Chad Pawson (Pawson, Chad, CBC News, and Pelmorex Corp. 2023) in a story for CBC, reported that "... cigarette butts are still the No. 1 most littered item in Vancouver" yet, he also said that only seven littering fines were assessed for the first ten months of 2023 in Vancouver. Additionally, he wrote: "...the City of Vancouver estimates more than 400,000 cigarette butts end up as litter in the city every day from residents alone ..." Riverkeepers (unknown last name, Jessica and River Keepers 2015) reports that "... the stormwater system ... carries 1 in every 10 dropped butts into our lakes, rivers, and streams." A report by the United Nations, UN Environment Programme (UN Environment Programme [@UNEP] 2022) wrote, "Cigarette butts are the most discarded waste item worldwide and are also the most common plastic litter on beaches." A CBC News video (CBC News 2019) gives evidence that Cigarette Butts are not biodegradable and the plastic micro-fibers from the filters are showing up in fish and insects.

The good news is that cigarette butts can - and are - being recycled. The TerraCycle Waste Management Company (TerraCycle Company 2024) is actively advertising to obtain more cigarette waste. It is also actively advertising for people to open more drop-off points. It's *UNSMOKE Cigarette Free Recycling Program*, currently has a drop-off point in Rocky View County near Balzac, which is just to the North of Calgary. Apparently, the demand is present, and there is a ready supply problem on the streets of Calgary, so, all that is needed is reliable method of collection.

Readers should be reminded that according to a Government of Alberta document titled *Regulated Stewardship Programs*, (Government of Alberta 2024) "The government neither provides money to nor receives money from the [Regulated Stewardship] programs." In other words, the costs of recycling is not a cost assumed by the government, and, by extension, Alberta taxpayers. The costs are obtained from recycling deposits and sales of recycled materials. Industry and the customers pay the cost. So, if the Alberta Government includes cigarettes in its deposit program under its *Regulated Stewardship Programs*, it will not cost The City of Calgary anything, as the costs to collect and recycle cigarette butts/waste, will be paid by Industry and the Consumers (i.e. Smokers).

If the Government of Alberta kick-starts such a deposit program on cigarette butts; they might feel a need to do some preliminary research - feasibility studies and the like - especially to gather data to determine what would be a fair financial incentive to induce people to collect the butts. Taxpayers would be annoyed if the government spent, for example, \$30,000 to determine how many butts a human could pick in an hour, so, I did the study and I am placing it in the Public Domain, so it is free for all. Hopefully, every city in the world will benefit from this essential information, because this is a world-wide problem and not just confined to Calgary.

Study Design.

Goals:

The Main goals are:

1. to count the number of litres of cigarette butts that a person can collect in an hour,
2. to determine the number of cigarette butts per litre,
3. to measure the area of the collection space,
4. to record the time it takes to cover each: city block, and each side of a city block.
5. to record the total number of hours spent collecting.

From the above measurements, I will be able to calculate:

1. number of cigarettes and number of litres collected per hour,
2. number of cigarettes per square meter of sidewalk, and if that changes over time,
3. total number of cigarettes and total number of litres collected overall,
4. total number of square meters covered,
5. average number of cigarettes dropped on the average Calgary city street per month,

Locations:

I adopted six downtown blocks, roughly, scattered across the downtown section of Calgary. The locations were:

1. 800 block of 4th Avenue S.W. (residential hi-rise and commercial small stores below)
2. 900 block of 7th Avenue S.W. (residential hi-rise and commercial small stores below)
3. 200 block of 5th Avenue S.E. (Old Calgary Education Building - abandoned, with a park on the Western half of the Block.)
4. 300 block of 12 Avenue S.W. (Memorial Park Library Block - 1 small coffee house; rest all park.)
5. 800 block of 10A Avenue S.W. (all commercial, except for one small house)
6. 800 block of 3rd Avenue S.W. (All mid-rise residential)

Additionally, I adopted two grassy, areas:

7. 200 block of 5th Avenue S.E. (Family of Man Park which is the western half of the Old Calgary Education Building block)
8. 800 block of 3rd Avenue S.W. (The front lawn of a private apartment building.)

Method:

I collected all cigarette butts in each block and grassy area every month for four months in a row, so I could determine if the number of cigarettes changed over time and to determine how many **new** cigarettes were dropped on the sidewalks per month. I attempted to accomplish these on the same day of the following month - weather permitting.

Equipment:

I am a paraplegic in a manual wheelchair. 1. I obtained a thirty-two-inch-long tool with two spring fingers and worked by a pistol-grip hand-grip action. On Amazon.ca, they are called “Reacher Grabber Pickup Tool” (MEDca 2024) and it sells for about \$34 CDN. 2. For a one Litre container, I used a waxed one-Litre milk container. I used a large tin can and poked a hole near the top, and used some copper wire to wire the tin can to the upright tube just above my left front wheel on my wheelchair. The milk container just fit into the large tin can snuggly, so the setup was perfect for me. The top of the milk container was 18 inches above the ground which as an advantage because I didn’t have to lift the cigarette butt so high as I would if I were standing, and it freed my left hand to use to push myself along in the wheelchair. A person who was walking could do the same setup by taping the container to their lower leg, just above the ankle. I’ve seen people collecting worms

[night crawlers] for fishing using that setup. 3. To time my collection periods, I just used the clock on my cell phone. I got the Reacher Grabber Pickup Tool free from the garbage, so my setup was, essentially, free.



Figure 1: Author Showing Collection Tool and Setup. Note the Green, One Litre Milk container for Collecting the Butts and the nice clean, butt-free sidewalk that has just been cleaned. Location: Family of Man Park, Calgary, Alberta, Canada. (Public Domain, October, 2024) Having previously offered me a pack of cigarettes and being shocked to hear I didn't smoke; a native guy returned later and asked me "what is your diagnosis?" He was implying that I was mentally ill. We shared a good-natured laugh. Those native guys have a very refined sense of humour. On another note: I witness that collecting cigarette butts is the absolute best method of destroying the vice of excessive pride – bar none.

Results Summary

Table 1: Synoptic Table of Facts about Collecting Cigarette Butts from, The City of Calgary, (Downtown) Sidewalks and their Associated Gutters, over the Four Consecutive Months of: July, August, September, and October, 2023.

Facts about Collecting Cigarette Butts from, The City of Calgary, (Downtown) Sidewalks and their Associated Gutters, Over the Four Consecutive Months of: July, August, September, and October, 2023.	Number	Units
Number of Butts Collected	14485	Number of Butts
Litres of Butts Collected	31.8	Litres
Hours spent Collecting	39.4	Hours
Number of Calgary Downtown Blocks in This Study	6	Number of Blocks
Average density of Cigarette Butts on Calgary Downtown Sidewalks plus Associated Street Gutters (on a recurring monthly basis)	0.29	(Butts/square meter/month)
Number of Calgary Downtown Grassy Areas in Parks in This Study	1	Number of Blocks
Density of Cigarette Butts on Calgary Downtown <i>Family of Man Park</i> (on a recurring monthly basis)	0.18	(Butts/square meter/month)
Number of Calgary Downtown Grassy Areas in front of Private Apartment Blocks in This Study	1	Number of Blocks
Density of Cigarette Butts on One Calgary Downtown Lawn in front of an Apartment Building with a lot of smokers (on a recurring monthly basis)	1.0	(Butts/square meter/month)
Total Area of Sidewalks (and Street Gutters) included in this Study	11,187	Square Meters
Total Area of Grassy Areas included in this Study	3,149	Square Meters
Total Area of Sidewalks, Gutters, and Grassy Areas included in this Study	14,336	Square Meters
Time frame of This 2023 Study	July, August, September, and October	Name of Months

Table 2: Synoptic Table of Ratios Derived from the Facts:

Ratios Derived from the Above Facts.	Ratios	Units
Average Number of Cigarette Butts - on a recurring Monthly Basis - for a Typical City Downtown Block with Sidewalks plus Gutters of 1850 square meters.	575	(Number of Butts per Typical Calgary City Downtown Block per month)
How Many Cigarette Butts are there in one Litre - in Practice?	475 (median) (std. dev. 94) (N=29)	Butts/Litre
On Average, how many Cigarette Butts Can a Human Collect, with a <i>Reacher Grabber Pickup Tool</i>, in an Hour?	368	Butts/Hour
On Average, How Many Litres of Cigarette Butts can a Human Collect, with a <i>Reacher Grabber Pickup Tool</i>, in one Hour?	0.8	Litres/Hour
In Practice, How long does it take for a Human to Collect one Litre of Cigarette Butts, with a Reacher Grabber Pickup Tool?	1 hour: 30 minutes	Hours (:Minutes) per Litre
Butt Pickup Rate: In Practice, How long - on average - did it take for the motivated Human in this Study to Collect each Cigarette Butt, with a <i>Reacher Grabber Pickup Tool</i>?¹	9.8	Seconds/Butt
Financial Incentive Necessary for a Human to Earn Minimum Wage Collecting Cigarette Butts in Calgary, Alberta, Canada. (Note: Minimum Wage in Canada is \$15/hour)	19.00	\$ (in CAD)/Litre
Per Cigarette Butt Deposit Necessary for a Human to Earn Minimum Wage Collecting Cigarette Butts in Calgary, Alberta, Canada.	0.04	\$ (in CAD)/Cigarette Butt

Results in Detail:

Table 3: Number of Cigarette Butts Collected, Litres Collected, and Collection Time, By Month and By Location.

Loc. no.	Loc. Descript.	Number of Butts Collected (no. Butts)				Litres Collected				Collection Times (Minutes)			
		Jul.	Aug.	Sept.	Oct.	Jul.	Aug.	Sept.	Oct.	Jul.	Aug.	Sept.	Oct.
	Sidewalks and Gutters:												
1	800 block of 4th Ave SW	448	561	601	796	0.7	1.1	1.2	1.9	60	85	80	110
2	900 block of 7th Ave SW	807	823	916	795	1.7	2.0	2.7	2.1	160	150	150	135
3	200 block of 5th Ave SE	796	593	495	325	1.6	1.1	1.0	0.7	135	100	75	65
4	300 block of 12th Ave SW	399	475 ²	517	230 ³	0.8	1.1	1.1	0.4	80	70	100	45
5	800 block of 10A Ave SW	255	427	279	383	0.4	0.8	0.4	0.8	60	70	50	65
6	800 block of 3rd Ave SW	n/a ⁴	770	546	579	n/a	1.8	1.1	1.4	n/a	90	75	85
	Grassy Areas:												
7	200 block of 5th Ave SE	n/a	435	262	101	n/a	1.0	0.6	0.3		80	45	35
8	800 block of 3rd Ave SW	n/a ⁵	456	236	179	n/a	1.1	0.6	0.3	n/a	60	30	20
Totals		2705	4540	3852	3388	5.2	10	8.7	7.85	495	705	605	560
Totals		14,485				31.8				2365			

Table 3a: Collection Speed by Month in Litres per Hour.

Collection Speed by Month	July	Aug	Sept	Oct
Collection Speed by Month (Litres per hour)	0.6	0.9	0.9	0.8

Table 3b: Total: Butts, Litres and Collection Time over Four Month Study.

Total Butts, Litres and Collection Times, Over the Four Month Study	Numbers
Total Butts Collected over the four-month Study:	14485 (butts)
Total Litres Collected over the four-month Study:	31.8 (Litres)
Total Collection Time over the four-month Study:	39.4 (hours)

Table 4: Number of Cigarette Butts Collected and Litres Collected, and Butts per Litre By Month.

Loc. no.	Loc. Descrip.	Number of Butts Collected (from Table 3) (no. Butts)				Litres Collected (from Table 3) (no. Litres)				Butts/Litre Otherwise: (last row, in blue, is Average Butts/Litre By month)			
		Jul	Aug.	Sept.	Oct.	Jul	Aug.	Sept.	Oct.	Jul	Aug.	Sept.	Oct.
	Sidewalks and Gutters:												
1	800 block of 4th Ave SW	448	561	601	796	0.7	1.1	1.2	1.9	640	510	501	419
2	900 block of 7th Ave SW	807	823	916	795	1.7	2.0	2.7	2.1	475	412	339	375
3	200 block of 5th Ave SE	796	593	495	325	1.6	1.1	1.0	0.7	498	539	495	465
4	300 block of 12th Ave SW	399	475	517	230	0.8	1.1	1.1	0.4	499	432	470	575
5	800 block of 10A Ave SW	255	427	279	383	0.4	0.8	0.4	0.8	638	534	698	479
6	800 block of 3rd Ave SW	n/a	770	546	579	n/a	1.8	1.1	1.4	n/a	428	496	414
	Grassy Areas:												
7	200 block of 5th Ave SE		435	262	101		1.0	0.6	0.3		435	437	337
8	800 block of 3rd Ave SW	n/a	456	236	179	n/a	1.1	0.6	0.3	n/a	415	393	716
	Totals by Month:	2705	4540	3852	3388	5.2	10	8.7	7.9				
	Average Butts Per Litre By Month ⁶									520	454	443	429

Table 4a: Calculation of Average Butts per Litre by Month.

Data	Values			
	July	Aug.	Sept.	Oct.
Total Butts Collected by Month: from Table 4	2705	4540	3852	3388
Total Litres Collected by Month: from Table 4	5.2	10	8.7	7.9
Total Butts /Total Litres by Month (total butts/total litres)	520	454	443	429

Table 4b: Summary of Butts per Litre.

Average Butts per Litre over the Four-month Study	Number
Average Butts per Litre Calculated by (total butts/total litres) From Table 1 (butts per litre)	456
Average Butts per Litre calculated by Average of butts per litre by month from Table 4a (i.e. ave. of (520, 454, 443, 429))	462
Median Butts per Litre calculated using data from: all months and all locations from Table 4	475 (Std. dev. = 94 (N=29)

Table 5: Number of Cigarette Butts per Square Meter of: Sidewalk and Gutters (excluding Grassy Areas) By Month and By Location.

Loc. no.	Location Description	Number of Butts Collected (from Table 3) (no. Butts)				Area of Sidewalk and Gutter (whole block) (Loc. 1-6) (square meters)	Density of Butts (Butts per square meter) Otherwise: (row, in blue, is Average Butts/sq. m. By month)			
		July	Aug.	Sept.	Oct.		July	Aug.	Sept.	Oct.
	Sidewalks and Gutters:									
1	800 block of 4th Ave SW	448	561	601	796	2283	0.2	0.2	0.3	0.3
2	900 block of 7th Ave SW	807	823	916	795	2059	0.4	0.4	0.4	0.4
3	200 block of 5th Ave SE	796	593	495	325	1482	0.5	0.4	0.3	0.2
4	300 block of 12th Ave SW	399	475	517	230	1696	0.2	0.3	0.3	0.1
5	800 block of 10A Ave SW	255	427	279	383	1385	0.2	0.3	0.2	0.3
6	800 block of 3rd Ave SW	n/a	770	546	579	2283	n/a	0.3	0.2	0.3
	Column Totals:	2705	3649	3354	3108	11,188				
	Total Butts on Sidewalks and Gutters (no. of Butts)	12,808								
	Average butts per square meter by Month:						0.31	0.33	0.30	0.27
	Average butts per square meter overall:						0.29			

Table 5a: Number of Cigarette Butts per Square Meter of: Grassy Areas (excluding Sidewalk and Gutters), By Month and By Location.

Loc. no.	Location Description	Number of Butts Collected (from Table 3) (no. Butts)				Area of Grassy Areas (Loc. 7, 8) (square meters)	Density of Butts (Butts per square meter) By month			
		July	Aug.	Sept.	Oct.		July	Aug.	Sept.	Oct.
	Grassy Areas:									
7	200 block of 5th Ave SE	n/a	435	262	101	2856	n/a	0.15	0.10	0.04
8	800 block of 3rd Ave SW ⁷	n/a	456	236	179	293	n/a	1.56	0.81	0.61
	Column Totals:	n/a	891	498	280	3,149				
	Total Butts in the Grassy Areas: (in number of Butts)	1669								

Table 5b: Calculation of Average Butt Density per Month by Location Type.

Average Butt Density per Month by Location Type	Number
Average Butt Density per Month for Sidewalks and Gutters (excluding Grassy Areas) based on the data in Table 5: $12,808 \text{ butts} / 4 \text{ months} = 3,202 \text{ butts/month}$. $3,202 \text{ butts/month} / 11,188 \text{ square meters} = 0.29 \text{ butts per square meter per month}$ (butts per square meter per month on sidewalks and gutters)	0.29
Average Butt Density per Month for Grassy Areas (excluding Sidewalks and Gutters) based on data in Table 5a: $1669 \text{ butts} / 3 \text{ months} = 556 \text{ butts/month}$. $556 \text{ butts/month} / 3,149 \text{ square meters of grassy areas} = 0.18$ (butts per square meter per month) ⁸	0.18

Table 5c: Calculation of Average Butt Density per Month for All Location Types Combined.

Calculation of Average Butt Density per Month for all Location Types Combined	Number
<p>Based on the data in Table 5 and Table 5a:</p> <p>Total Butts on Sidewalks (Table 5): 12,808</p> <p>Sidewalk butts per month = $12,808 / 4 \text{ months} = 3,202$ butts/month</p> <p>Total Butts on Grassy Areas (Table 5a): 1,669</p> <p>Grassy Area butts per month: $1,669 \text{ butts} / 3 \text{ months} = 556$ butts/month</p> <p>Total butts per month: $3,202 + 556 = 3,758$ butts per month overall</p>	3,758
<p>Total Area of Sidewalks (and Gutters) (Table 5): 11,188 sq. m.</p> <p>Total Area of Grassy Areas (Table 5a): 3,149</p> <p>Total Area = $11,188 + 3,149 = 14,337$ sq. m.</p> <p>Therefore: Total Sidewalk and Gutter and Grass Area (square meters)</p>	14337
<p>Average Butt density for Sidewalks and Gutters and Grassy Areas per month</p> <p>Equals:</p> <p>Total butts per month overall / total combined area:</p> <p>$3,758 \text{ butts per month} / 14,337 \text{ square meters} = 0.26$ butts per month per square meter overall.</p> <p>(butts per square meter per month overall)</p>	0.26

Discussion of Results.

The Extent of the Problem of Cigarette Butts in Calgary.

Just a single one-pack-a-day smoker produces nearly 800 cigarette butts per month assuming 25 cigarettes per pack. I collected 14,485 butts over four months, which is about 3600 butts a month and I was expending ten hours a month of labour during this study. Essentially, it was taking me 10 hours to pick up the litter of just four smokers. Statistics Canada reports that 11.5% of Albertans smoke. Calgary.ca reports that the population of Calgary was 1,306,780 in 2021, therefore we can calculate that there are 150,280 smokers in Calgary. And - I repeat, to emphasize the main point - it took me **ten hours a month of labour**, to pick up the butts from just **four smokers** and there are 150,280 smokers in Calgary (Government of Canada 2017) and I don't smoke!

This study establishes the fact that the average density of Cigarette Butts on an average downtown city block is 0.29 butts per square meter per month or stated another way, almost 3 butts per 10 square meters of sidewalk. That sounds to the ear like a small number, but consider this. The wing-span of a tall man, from finger-tip to finger-tip is almost two meters - yes, I said a tall man, a meter is a little longer than a yard. So, if he stretches out his arms as wide as he can, he has two meters under his arms. If he does a twirl, like a ballerina, the area under his arms is given by the formula ($A=\pi r^2$), which is 3.1 square meters. In that area, you will find one cigarette butt, on the average Calgary sidewalk, and you would have to do two twirls in different spots in a grassy park to find one cigarette butt. And if you are so kind as to pick it up the cigarette butt you discover, and put it in a garbage can, and pass by that place a month later, there will be another butt waiting for you - every month - forever.

A Thank you to Smokers.

It must be acknowledged that smokers ought to be thanked for not tossing their butts in the nearest garbage can, because even the smallest unnoticed spark could start a fire. Smokers know this, and take the safest and most logical step of leaving them well away from combustibles, such as on a sidewalk. There are just no publicly accessible containers for cigarette butts. Society, should, and must cooperate to meet this need.

Putting a Price on Litter via a Refundable-Deposit: A Time-Tested and Successful Solution.

In the history of Calgary (and Alberta), it has been demonstrated that placing a refundable deposit on an item of litter will incentivize people to clear the litter. The Pop-can deposit program is a good example. This study calculates that an Alberta Minimum-Wage level of incentive would be four cents per cigarette butt. In Table 2, my average Pickup rate was 9.8 seconds per butt. It is important to note that that time includes the time to move from the last butt pickup to the next butt. Also note in Table three under the heading *Total Collection Speed by Month* that in July, I was picking up 0.6 Litres per hour, but in August, I had increased my speed to 0.9 Litres per hour, a 30% increase and I held this higher speed for the duration of the study. I would like to witness that I was really working up a sweat while doing this work and I was not taking any breaks. Once, there was a rain shower, so

I went off-clock for twenty minutes during the rain shower. The collection times in this study do not include any breaks.

Who do you know in Calgary that is willing to work up a sweat for minimum wage? Almost no one. Therefore, the data in this study ought to be considered as a minimum, base-line, level of incentivization to do this type of work. I strongly recommend that a refundable deposit on cigarette butts should not be set at less than four cents per butt. In the Introduction, I noted that Shenna Gallager got paid to collect cigarette butts in Calgary at a rate of five cents per butt, and that was in 2009. The Bank of Canada inflation calculator (Bank of Canada 2024), says that four cents in 2009 is the same as six cents in 2023. I am sure that Shenna's body really hurt after accomplishing her feat. I imagine she had no tool and was doing it by hand too. Would you be willing to do 10,000 squats or waist-bends thirteen hours a day for two days for minimum wage?

I suggest that it would be wise to set a refundable recycling deposit on cigarette butts on a practical, free enterprise model: begin at the lower part of the range, and slowly increase it every year, as the butts become more scarce, and judge the appropriate level of incentivization according to the butt density on city sidewalks. The key point would be to plan for regular increases. During the study, I noticed several small areas that I couldn't access in my wheelchair that held, perhaps, a thousand butts. Also, when you look down through the grates in the sidewalk that house electrical transformers underground, I believe I see a large accumulation of butts, perhaps twenty centimeters thick. City Electrical Workers would be able to either confirm or deny this. Of a Refundable-Deposit program were to be instituted, then it would be wise to start at a low compensation rate of four cents for the first summer season, because these small local areas with large numbers of butts would be easy pickings. These areas would be collected first, and then, after, people would have to expend more time and effort to collect from the sidewalks. In consideration of the extra effort needed in the second season, it would be good to plan to increase the Refundable-Deposit Rate to six cents the second year and seven cents in the third year. These should be considered absolute minimum numbers.

Seasonal Variation in the Density of Butts.

I was expecting that my first collection pass in July would yield the largest number of butts due to years of accumulation, and that the second pass in August, on the same block, would yield a much smaller number of butts, but that expectation does not seem to be revealed in the data. In some cases, for example, in location number one and five, the second pass was larger. Perhaps there is a seasonal variation with the largest butt drop rate during the warmest summer months. Of note is Table 5 where both the Number of Butts by Month and the Density of Butts per Square Meter by Month formed a peak in August and decreased steadily in September and October.

The data suggests that the number of butts are not accumulating year by year to any large extent on sidewalks, in visible areas. So where do they go? A reasonable assumption would be: down the below-ground electrical transformer room grates, down the storm sewer grates, swept up by the street cleaning trucks, and collecting under the grates around the trees planted along the sidewalks - all hidden places.

Grassy parks data told a different story, with a high density of butts on the first cleaning, and the density dropped off sharply with each successive month (*See Table 5a*). This suggests that butts are accumulating in grassy parks. This idea seems logical, since cigarette butts on a sidewalk would tend to roll toward the gutter or into the grates around the bases of trees as people accidentally kick them, but in grassy parks, the butts would tend to stay in one place. In location number 8, which is a private apartment building with a lot of smokers, I report that the smokers saw me collecting butts, and at the end of August a garbage can appeared outside and some of the smokers started to put their butts into the garbage can. This observation demonstrates that smokers are willing to change their practices.

This was just a small study and I added more blocks to my collection area in August, so I only have three data points for three of the locations. A larger study over a larger number of months and more complete data on all locations would reveal such seasonal variation information. Those type of studies would be better initiated after a collection program is well underway. This study should be considered just an initial exploration of the basic facts about the practical experience of collecting butts.

Butts per Litre.

It is not advisable to pay a deposit based on weight of cigarette waste because scammers will soak the butts in water and then the bottle depot will be paying for water. Paying by volume is the way to go. This study establishes the fact that, on average, there are 475 butts in a litre. This study is not big enough to establish a proper statistical plus and minus range. I was just eye-balling a one litre waxed cardboard milk container and estimating fractions thereof. Also, I noticed that the length of the butts varied by the class of neighbourhood. Poorer smokers only left the filter, while more affluent neighbourhoods, such as near the Memorial Park Library Park, the butts were much longer. The authority in control of the butt deposit program will have to develop the standards for estimating the number of butts and I'm sure those standards will evolve and improve over time. Alberta has a chance here to become a world leader in this field.

Economic Considerations Regarding the Collection of Cigarette Butts.

In Canada, Tax Rates on Cigarettes is commonly quoted as the Tax per Carton of 200 cigarettes (8 packages of 25 cigarettes). Currently, (2024), according to (Worrell and Hagen 2021) the Alberta Tax Rate is \$55/carton and Manitoba is the highest at \$60/carton. Alberta has a habit of going long periods of not increasing the taxes on tobacco - only increasing them from time to time, as the need arises. Alberta raised the Tax by \$5 to \$50/carton in 2015, "the first jump in six years" as reported by (Bellefontaine and CBC News 2015). In 2019, they raised it by \$5/carton again to \$55/carton where it stands today - six years later (Black 2019).

If we consider the minimum incentive to collect the butts of four cents, we must consider that that amount would not cover the costs of the whole program. There would also be Administration cost, Management cost and Infrastructure cost and I'm guessing that these costs might amount to another four cents per butt. Afterall, the Bottle Depot needs to pay their staff, and there is a need to store the butts and perhaps dry them and buy containers in which to transport them to the recycler. I don't imagine that the recycler would pay for the butts at this time with the small number of butts they are currently getting. A Collection Program costing ten cents per cigarette would amount to \$20/carton, which is nearly half of what the Alberta Government presently collects in Cigarette Taxes and since Manitoba has the highest Tax rate of \$60/carton, that doesn't leave much room to raise the Cigarette Taxes.

Of course, Pop-can Refundable-Deposit Program is not funded by direct Taxes, and a similar program for cigarette butts could follow the same path, but a pot of money is needed to kick-start the program, and the logical place to get that money is from direct Taxation of Cigarettes, even if only for a couple of years.

This Researcher's Vision on How Alberta should Budget for a Refundable-Deposit on Cigarette Butts.

First, we need a multi-faceted approach. Clearly, it is inefficient and expensive to pick up the butts after they have been thrown away. We need to get the smokers to deposit their butts into proper containers themselves. I propose that the Province of Alberta needs to get the cities (Calgary, Edmonton etc.) to subcontract the collections. They can put out a call for proposals. The inventors can design receptacles that can be strapped to light standards beside bus shelters. The subcontractors can be responsible for supplying the receptacles of their own design, and they will be responsible for their equipment and monthly collection and also to clean up a small sidewalk area around the bus shelter. The city could take a 10% share of the Refundable-Deposit for the use of their light-standards and would assume responsibility only for any damage to the light-standard when drug-users try to steal the butts from the receptacle so they can go buy more drugs. The subcontractors need to design their receptacles with anti-theft in mind. As an example, Chad Pawson (Pawson, Chad, CBC News, and Pelmorex Corp. 2023) shows a picture of a cigarette receptacle strapped to a street-light-standard in Vancouver, and states that they are "often vandalized". Clearly, the receptacle in the photo needs a better design. But, consider that if these receptacles in Vancouver are being vandalized now, how much more will they be vandalized when the butts are worth money?

Second, the Alberta Government should raise the Cigarette Tax immediately by \$5/carton, from the current \$55/carton to \$60/carton, plus institute that the Tax be Indexed to Inflation plus 1% above Inflation. This way, they will be planning for regular, yearly increases. If they don't increase the Tax every year, then inflation makes the cigarettes more affordable every year. A sin-tax should never go down. Then they need to delay making any payouts for a year, and accumulate the deposits to pay for infrastructure and Management planning for the program, plus the extra year will reduce the inventory of cigarette butts on the ground for which deposits have not been collected. They need a pot of money to jump-start the program. Then should also ear-mark an additional \$5/carton from the current \$55/carton Tax for recycling, giving them a total of \$10/carton for a recycling program. Of course, once the program is up and running, it could be funded entirely on Refundable-Deposits like the Pop-can Recycling Program, so the input of Tax money would be only a one or two-year event.

Third, the Alberta Government should announce the commencement of payout of deposits after one year (perhaps the Spring of 2025), and in the meantime, negotiate with the other Western Provinces to get them to institute the same program and get their cooperation to all raise the Cigarette Taxes in unison on a regular schedule or, if they go the Refundable-Drop only route, they still need other Province's cooperation in setting a common payout on the Deposit. This policy would minimize arbitrage.

Main Ideas: With the Tax Indexed above Inflation, and with the development of the Industry of Cigarette Butt Recycling, with the intention of being able to, eventually, sell the butts, and subcontractor collection share/fees, the Butt Recycling Program should, eventually pay for itself. Clearly, smokers are not paying the full cost of their habits, so steps need to be taken to place the full costs on the smokers instead of the non-smokers who have to clean up after the smokers. I believe that if proper receptacles are provided in places where smokers imbibe in their habit, such as at Bus shelters, they will deposit their own Butts in the proper receptacles themselves. I also believe that inventors will design a drug-user resistant receptacle so they can't steal the butts, like they currently steal pop cans from the pop can recycling bins. All it takes is a little innovation and competition of design.

Appendix A: Butts Collected by Location and by Individual Sidewalks on each Side of the City Block.

Loc. no.	Location Description (and Block Side)	Number of Butts Collected by Block Side. ⁹ (no. Butts)				Location Average (whole block)
		July	Aug.	Sept.	Oct.	
1	800 block of 4th Ave SW Hi-rise Residential with commercial on 1st floor					
	North	104	121	223	309	
	West	96	82	112	153	
	South	148	197	158	243	
	East	100	161	108	91	
	Location Sum	448	561	601	796	602
2	900 block of 7th Ave SW Hi-rise Residential with commercial on 1st floor					
	North	400	489	614	417	
	West	97	95	70	127	
	South	174	135	108	93	
	East	136	104	124	158	
	Location Sum	807	823	916	795	835
3	200 block of 5th Ave SE Old Education Building					
	North	135	230	145	126	
	West	138	113	107	55	
	South	335	162	131	103	
	East	188	88	112	41	
	Location Sum	796	593	495	325	552
4	300 block of 12th Ave SW Memorial Park Library					
	North	100	251	148	88	
	West	56	85	106	72	
	South	197	59	170	42	
	East	46	80	93	28	
	Location Sum	399	475	517	230	405
5	800 block of 10A Ave SW Low-Rise Commercial					
	North	109	224	115	141	
	West	26	46	84	104	
	South	94	114	42	112	
	East	26	43	38	26	

Loc. no.	Location Description (and Block Side)	Number of Butts Collected by Block Side. ⁹ (no. Butts)				Location Average (whole block)
		July	Aug.	Sept.	Oct.	
	Location Sum	255	427	279	383	336
6	800 block of 3rd Ave SW					
	Low-rise Residential					
	North		211	24	61	
	West		44	29	39	
	South		402	436	412	
	East		113	57	67	
	Location Sum		770	546	579	632
	Totals of Location Sums: for sidewalks and gutters	2705	3649	3354	3108	

Appendix B: Butt Collected and Average Butt Collected by Location Type.

Loc. No.	Location Type Description	Number of Butts Collected (number of butts by month)				Average number of butts by Location Type. (butts per month)
		July	Aug.	Sept.	Oct.	
	Totals of Six Locations: of sidewalks and gutters (from Appendix A)	2705	3649	3354	3108	3204
	Totals of Two Locations: of grassy areas. (from Table 3)	n/a	891	498	280	556
	Total Butts for both Sidewalks (and Gutters) and Grassy Areas by Month	2705	4540	3852	3388	

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Endnotes

¹ Note: This time includes traveling time. In other words, the time, starting from the previous drop of the butt in the container, plus the time to get to the next butt, plus the time to pick up the butt and drop it into the container.

² The North, East and South side of this block was cleaned of butts sometime in the last month previous to paint sidewalk art. I could not determine the exact date but it was, perhaps a few days before August 3rd. I collected on August 16th. Perhaps, this number of butts only represents about 16 days of accumulation. This piece of data is, therefore, reduced from what one would normally expect.

³ The North, East and South side of this block was cleaned of butts sometime in the last month previous to remove sidewalk art. I could not determine the exact date. This piece of data is, therefore, reduced from what one would normally expect.

⁴ I cleaned the East and South side of this block about two months previous to the beginning of this study. I didn't count the number of butts.

⁵ I cleaned this lawn of butts about two months previous to the beginning of this study, so I didn't count the number of butts. Also note, that about twenty-five percent of the park, especially on the east side, has a hill where smokers and druggies like to congregate, so they can see the cops coming. The hill was too steep for a wheelchair, so I couldn't access that area. Therefore, I could only collect in 75% of the park. So, the area quoted only represents seventy-five percent of the area of the park. If I could have reached those areas, the density of butts - I would guess - would be, perhaps, twenty to thirty percent higher.

⁶ Average Butts per Litre calculated as Total Butts divided by Total Liters from the row above.

⁷ Note that location number 7 (the *Family of Man Park*) has ten times the area of location number 8 (a private apartment building with quite a few smokers) yet, the number of butts are pretty well the same. This means that location number eight has a much higher Density of Cigarette Butts per square meter. Location number 8 is not typical of Calgary, but does illustrate the upper extreme of Butt litter.

⁸ The Butt density – overall - for the Grassy Areas is 0.18 butts per square meter. For location 8, the Butt densities are much higher, (see *Table 5a*) but the area is very small compared to the *Family of Man Park*, (Location number 7) so the high densities in location 8, do not affect the overall density very much.

⁹ Note Appendix A, refers only to Sidewalks and Gutters in Locations 1 to 6. Grassy Area Details (Locations, 7 and 8) are excluded.

(the end)